DOCUMENT RESUME

ED 144 926 SP 011 485

AUTHOR Kleucker, Joy
TITLE Effects of Protocol and Training Materials. Acquiring Teaching Competencies: Reports and Studies.
INSTITUTION National Center for the Development of Training Materials in Teacher Education, Bloomington, Ind.
SPONS AGENCY National Center for Improvement of Educational Systems (DHEW/OE), Washington, D. C.
PUB DATE Sep 74
NOTE 33p.

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS Audiovisual Aids; Audiovisual Instruction; Concept Teaching; Educational Research; Instructional Materials; Microteaching; *Performance Based Teacher Education; *Preservice Education; *Protocol Materials; Teacher Education; Teaching Skills; *Training Techniques

ABSTRACT

This study reports on research concerning the effects of instruction based on protocol materials and training materials on concept acquisition and skill acquisition. Direct or intended outcomes, differential outcomes, and combined-effects outcomes of protocol and skill training instruction were investigated. The following hypotheses, two for each of the major outcome areas, were examined, using 38 undergraduate education students as subjects: (1) subjects who receive only protocol instruction will perform better on tests of concept recognition than a control group; (2) subjects who receive only skill training instruction will perform better on a skill performance measure than a control group; (3) subjects who receive only protocol instruction will perform better on tests of concept recognition than those who receive only skill training instruction; (4) subjects who receive only skill training instruction will perform better on a skill performance measure than those who receive only protocol instruction; (5) subjects who receive both protocol and skill training instruction will perform better on tests of concept recognition than those who receive only protocol instruction; and (6) subjects who receive both protocol and skill training instruction will perform better on a skill performance measure than those who receive only skill training instruction. The design of this research is described in this paper, testing procedures are outlined, and results are analyzed. Results indicate that a combination of protocol instruction and skill training instruction is an effective teaching technique. (JD)

Documents acquired by ERIC include many informal unpublished materials not available from other sources. ERIC makes every effort to obtain the best copy available. Nevertheless, items of marginal reproducibility are often encountered and this affects the quality of the microfiche and hardcopy reproductions ERIC makes available via the ERIC Document Reproduction Service (EDRS). EDRS is not responsible for the quality of the original document. Reproductions supplied by EDRS are the best that can be made from the original.

This series is published and distributed under the auspices of the National Center for the Development of Training Materials in Teacher Education. The National Center has been initiated and supported by a grant from the National Center for the Improvement of Educational Systems, U.S. Office of Education.

The primary objective of this publication series is to provide an outlet for theoretical, procedural, technical and evaluational reports and studies in the development of protocol and training materials, and in their use in the acquisition of teaching competencies.

The editorial advisory board functions primarily to set policy regarding directions and purposes of the publication and areas of needed publication. Editors for each report will be selected from those listed below.

Associates of the National Center at Indiana University

Laurence D. Brown
David Gliissman
Gary M. Ingersoll
W. Howard Levie
James R. Okey
Philip G. Smith
Richard L. Turner
James D. Walden

External Editorial Board Members

David Berliner
Far West Regional Educational Laboratory
Berkeley, California
Bryce B. Huogins
Washington University
St. Louis Missouri
B. Othanel Smith
University of South Florida, Tampa, Florida

Manuscripts for consideration should be submitted to:

National Center for the Development of Training Materials in Teacher Education
Indiana University
2805 East Tenth Street
Bloomington, Indiana 47401

Effects of Protocol and Training Materials

Joy Kleucker

Report #6, September, 1974

PB 000 44

FOREWORD

For several years, those of us who have devoted much time and energy to the creation of protocol and training materials have been operating on the basis of relatively untested assumptions. For example, there is the assumption that protocol materials in fact lead to the acquisition of meaningful, useable concepts. Similarly, there is the assumption that training materials lead to the acquisition of teaching skills which are likewise meaningful and useable. Both of these assumptions now have some supportive data. More centrally, however, there are the assumptions that protocol and training materials lead to differential outcomes, and that given a teaching skill for which there is a strong conceptual base that the combined effects of protocol and training materials are additive.

In the accompanying paper, Dr. Kleucker selects a skill area having a strong conceptual base, making appropriate the construction of a complementary set of protocol and training materials. Using a procedure, design, and sample tests reasonably adequate to the task, she cites conventional hypotheses predicting levels of concept acquisition from protocol materials and skill acquisition from training materials. Then, she tests a set of hypotheses calling for crossing the dependent variables with the experimental groups and assessing the level of skills developed from protocol materials, the level of concept development from training materials, and the additive effects of both materials on concept and skill development.

The results of her study generally are supportive of several of the basic assumptions but particularly that of the additive effects of the two kinds of materials. The differential effects of protocol and training materials were not clearly supported by the data, hence setting the stage for further exploration.

Hopefully, this study is the first of several serious efforts to produce data having direct bearing on the theoretical foundations of the protocol and training materials movement.

L.D. Brown, Editor

Effects of Protocol and Training Materials

Joy Kleucker

Indiana University

The purpose of this paper is to present the results of a study which attempted to answer several major questions concerning the outcomes of instruction based on protocol materials and training materials. Perhaps the most important question for developers and users of protocol and training materials is whether these materials do, in fact, lead to the acquisition of educationally relevant concepts and teaching skills. Other questions of importance concern the relationship between the outcomes of these two types of instructional materials. Do protocol materials and training materials lead to differential outcomes? Are they more effective when used in combination or alone?

There has been very little research on the outcomes of protocol-based instruction and only slightly more research on the outcomes of instruction based on training materials. In the only reported study which used materials explicitly designed as protocol materials, Barnes (1972) reported that filmed protocol instruction led to greater concept acquisition and transfer than expository instruction. Two previous studies, however, used protocol-like materials and reported gains in terms of conceptual outcomes (Johnson, 1968; Koran, Snow, and McDonald, 1971). These studies generally supported the hypothesis that instruction based on protocol or protocol-like materials does lead to the acquisition of educationally relevant concepts.

Similarly, studies which have reported the outcomes of instruction based on training materials (Borg, 1972; Borg, Kallenbach, Morris, &

Friebel, 1969; Borg, Kelley, Langer, & Gall, 1970; Langer & Allen, 1970; Wallen & Utsey, 1969) have generally demonstrated that the use of training materials does lead to the acquisition of specific teaching skills. However, each of these studies contained what may be called a protocol-like component (instructional and model films and videotapes illustrating the skills to be learned). In some of the studies (Borg, Kallenbach, Morris, & Friebel, 1969; Langer & Allen, 1970; Wallen & Utsey, 1969), subjects were even required to analyze the model films or videotapes. It is unclear to what extent these protocol-like components influenced the outcomes of the studies.

In summary, then, there is some limited evidence in the literature that the use of protocol materials leads to the acquisition of educationally relevant concepts and, that the use of training materials leads to the acquisition of specific teaching skills. However, there has been no reported research comparing the outcomes of protocol and training materials, nor has there been any reported research comparing the outcomes of instruction based on both types of materials with instruction based on either type of materials alone.

The present study attempted to answer major questions concerning the effects of instruction based on protocol materials and training materials on concept acquisition and skill acquisition. Direct or intended outcomes, differential outcomes, and combined-effects outcomes of protocol and skill training instruction were investigated. Six hypotheses-two for each of the major outcome areas-were tested. The first hypothesis in each area was concerned with the measurement of concept acquisition. The second hypothesis in each area was concerned with the measurement of skill acquisition. The following hypotheses were tested:

Direct or Intended Outcomes

Hypothesis I: Ss who receive only protocol instruction will perform better on tests of concept recognition than a control group.

Hypothesis II: Ss who receive only skill training instruction will perform better on a skill performance measure than a control group.

Differential Outcomes

Hypothesis III: Ss who receive only protocol instruction will perform better on tests of concept recognition than Ss who receive only skill training instruction.

Hypothesis IV: Ss who receive only skill training instruction will perform better on a skill performance measure than Ss who receive only protocol instruction.

Combined-Effects Outcomes

Hypothesis V: Ss who receive both protocol and skill training instruction will perform better on tests of concept recognition than Ss who receive only protocol instruction.

Hypothesis VI: Ss who receive both protocol and skill training instruction will perform better on a skill performance measure than Ss who receive only skill training instruction.

General Design

Ss were 38 undergraduates enrolled in two sections of an educational psychology course required for teacher certification. A 2 X 2 factorial design was used in which the presence or absence of the independent variables, protocol instruction and skill training instruction, was systematically varied. Ss were randomly assigned to one of four groups-three experimental treatments and a control group. Ss received either protocol instruction, skill training instruction, both, or neither (control group).

Ss who received either protocol instruction or skill training instruction (both experimental instruction) received instruction in two categories of teacher reactive behavior: asking probing questions and offering accepting reactions. Ss who received protocol instruction were trained in the conceptual understanding and interpretive use of these two categories of behavior. Ss who received skill training instruction were trained in the skilled performance of these behaviors. Ss in the control group received instruction on topics unrelated to these two behaviors (non-related instruction).

The two dependent variables were 1) Ss' ability to recognize and categorize these behaviors when they occured a) in videotaped excerpts of classroom interaction and b) in printed excerpts of classroom interaction and 2) Ss' ability to perform these behaviors in a microteaching lesson. Post-measures of the two dependent variables of concept acquisition and skilled performance were taken.

The experimental instructor was a graduate student who had prior experience in teaching educational psychology. He taught the experimental instruction to the three treatment groups. The instructor remained constant throughout the experimental instruction to the three treatment groups in order to control for the effects of instructor personality variables and teaching style.

Another graduate student who was currently teaching an introductory educational psychology course served as the non-related instructor. She met with Ss who were in the control group, Ss who were awaiting the experimental instruction, and Ss who had completed the experimental instruction. She instructed these Ss on topics unrelated to the experimental instruction (non-related instruction). The purpose of the non-related instruction was twofold: 1) to serve as a placebo and 2) to control for the

variables of time so that all Ss would receive the same amount of classroom instruction

Materials

Protocol Instruction

Materials for the protocol instruction included two 10-minute protocol films, Patterns in Teacher-Pupil Interaction: Reacting to Pupil Responses I and II; and an instructional manual, "Analysis of Teacher-Pupil Interaction" (Ingersoll & Kleucker, 1971).

Skill Training Instruction

Materials for the skill training instruction included an instructional manual, "Skills in Teacher-Pupil Interaction"[1] (Okey & Walden, 1971); an audio stimulus tape; an audio recorder; and videotapes and video recorders for recording the microteaching sessions. Junior high school pupils from local schools were used as pupils during microteaching.

Instrumentation

In keeping with major hypotheses of the present study that protocol instruction and skill training instruction produce differential outcomes, tests were developed to measure the outcomes associated with each type of instruction. The goal of the protocol instruction was to train Ss in the conceptual understanding and interpretive use of two categories of teacher reactive behavior: asking probing questions and offering accepting reactions. Two tests, a videotape concept test and a printed concept test, were developed to measure the outcomes of the protocol instruction.

The goal of the skill training instruction was to train Ss to use the skills of asking probing questions and offering accepting reactions.

---

[1]Section 4 of the manual, "Practice with a film," was omitted from the skill training instruction in the present study. In the original version of the manual it was included as an optional section. Since it required students to view one of the films used during the protocol phase of instruction, it was feared that its inclusion might be a confounding variable in the present study.

Microteaching was selected as the performance test for measuring the outcomes of the skill training instruction.

Videotape Concept Test

The videotape concept test[2] was a 25-minute test composed of brief, videotaped excerpts of classroom interaction. The test included 24 excerpts taken from the least used scene in each of the two protocol films. At the end of each excerpt, Ss were required to classify the last teacher response by deciding whether or not it included an accepting reaction and/or a probing question. Ss recorded their responses on special answer sheets. The last teacher response in each excerpt was included on the answer sheets. The following is a sample item:

1.	"Okay, tell me about Eddie."	Accepting Reaction	Probe	Neither	Undecided

After viewing the videotaped excerpt, Ss circled the appropriate response or responses on their answer sheets. Each item was scored independently for accepting reactions or probes. Only these two categories of responses were scored. The "Neither" response was disregarded since it was redundant. In other words, subjects who circled the "Neither" response obviously did not circle either the "Accepting Reaction" or "Probe" responses. The "Undecided" response was also disregarded because it was not pertinent to the hypotheses tested in the present study. The test items of Ss who circled the "Undecided" response were scored according to how they marked the categories of "Accepting Reaction" and "Probe." The total number of correct responses constituted a S's score. The highest possible score on the videotape concept test was 48.

---

[2]Estimates of the reliability of the videotape concept test ranged from .78 to .86. Further information concerning the reliability or validity of the test may be obtained from the author.

Printed Concept Test

The printed concept test[3] was a 76-item test consisting of printed examples of classroom dialogue. Ss were required to categorize teacher responses by deciding whether or not they were examples of probing or accepting reactions. In addition, Ss were required to further classify each probe according to one of the following types:

Type 1: Factual meaning probe

Type 2: Implied meaning probe

Type 3: Application of knowledge probe

In this sense, the printed concept test provided a more sophisticated measure of Ss' understanding of the concept of probing than the videotape test because it required them to further discriminate among the three types of probing questions.

Microteaching Test

Microteaching was selected as the skill performance test. Ss were required to prepare and teach one 5-minute discussion lesson to two groups of 4-5 pupils from local junior high schools. Ss were told to focus on the skills of asking probing questions and offering accepting reactions and to use these behaviors whenever they seemed appropriate in their lessons.

The purpose of the first microteaching lesson was to desensitize Ss to the microteaching procedures and, particularly, to the use of the videotape equipment. Experience has shown that an S's first microteaching lesson simply is not a reliable measure of his abilities. For this reason, the second microteaching lesson was actually counted as the microteaching test. The lessons were videotaped. Two raters (with an inter-rater reliability of .91 for accepting reactions and .98 for probes) later counted

---

[3]Estimates of the reliability of the printed concept test ranged from .83 to .96. Further information concerning the reliability or the validity of the test may be obtained from the author.

the number of probes and accepting reactions used in each lesson. An S's score was the total number of probes and accepting reactions he used during the 5-minute lesson.

Instructional Procedures

On the first day of class all Ss met as a group together with the experimenter, the experimental instructor, and the non-related instructor. Ss were randomly assigned to one of four groups. Each group completed two 5-day cycles of instruction. Group 1 (protocol-only treatment) received protocol instruction during the first cycle and non-related instruction during the second cycle. Group 2 (skill training-only treatment) received non-related instruction during the first cycle and skill training instruction during the second cycle. Group 3 (combined protocol and skill training treatment) received protocol instruction during the first cycle and skill training instruction during the second cycle. Group 4 (control) received non-related instruction during both the first and the second cycles of instruction.

Post measures on the dependent variables for each group receiving experimental instruction were taken upon completion of that instruction. Post measures on the dependent variables for the control group were taken upon completion of the second cycle of instruction.

Figure 1 on the following page, using the code format proposed by Campbell and Stanley (1963), may serve to clarify the experimental design.

Experimental Instruction

The materials for the experimental instruction were used in an instructor-based fashion. That is, the experimental instructor was not required to adhere rigidly to the manuals. However, he was required to follow a set of standardized procedures in presenting the experimental instruction. Observers were present at all class meetings to record the sequence of instruction and the

Group 1	R	X_1	$O_m O_v O_p X_3$	
Group 2	R	X_3	X_2	$O_m O_v O_p$
Group 3	R	X_1	X_2	$O_m O_v O_p$
Group 4	R	X_3	X_3	$O_m O_v O_p$

Legend

R: random assignment

X_1: protocol instruction

X_2: skill training instruction

X_3: non-related instruction

O_m: microteaching test

O_v: videotape concept test

O_p: printed concept test

Figure 1. Experimental Design

degree to which the instructor adhered to the experimental procedures. The observer reports indicated that the instructor faithfully adhered to the procedures for the protocol instruction and the skill training instruction as they are described below.

Protocol instruction. During the protocol instruction, the experimental instructor used the following standardized procedures:

1) presented a rationale for learning the two concepts.
2) defined one of the concepts.
3) had Ss use the concept in analyzing the protocol film.
4) had Ss respond to the written exercises.
5) presented a summary of the concept.
6) repeated steps 1-5 until all parameters of both concepts had been covered. At no time did Ss attempt to practice or use the related skills.

Skill training instruction. During the skill training instruction, the experimental instructor used the following standardized procedures:

1) presented a rationale for learning the teaching skills.
2) presented definitions and written examples of both skills.
3) had Ss practice writing probes and accepting reactions.
4) had Ss respond to an audio stimulus tape with probes and accepting reactions.
5) had Ss teach three microteaching lessons in which they used the two skills.
6) had Ss view and evaluate the videotapes of their microteaching performances (with feedback provided by the instructor and another S functioning in the role of a peer-supervisor).
7) had Ss observe three microteaching performances of another S and serve as a peer-supervisor in helping him evaluate his performance.

The basic purpose and focus of the skill training instruction was at all times one of skill development and not, as in the case of protocol instruction, one of conceptual development.

Non-related Instruction

The purpose of the non-related instruction was twofold: 1) to serve as a placebo and 2) to control for the variable of time so that all Ss would spend the same amount of time in classroom instruction. The content of the non-related instruction was considered important only insofar as the non-related instructor did not at any time touch upon the concepts or skills taught in the experimental instruction. Observers were present at all class meetings to record the topics presented during the non-related instruction. The observer reports indicated that the non-related instructor did not at any time teach the concepts of probing questions, accepting reactions, or any related concepts.

Testing Procedures

The three tests of the dependent variables were administered in the following order: 1) the microteaching test, 2) the videotape concept test, and 3) the printed concept test. Because of the nature of microteaching, the microteaching test was individually administered. The videotape concept test and the printed concept test were administered as group tests on the day following the completion of the microteaching test by all Ss in a given group.

At the last class meeting of each group prior to testing, Ss received written instructions concerning the microteaching sessions which were used as the microteaching test. Ss were unaware that the microteaching sessions were a test. All Ss received the same instructions. They were told to prepare one 5-minute lesson on any topic which they would teach to two groups of 4-5 junior high school pupils. Embedded in the instructions for microteaching was a mild set to use the skills of asking probing questions and offering accepting reactions. Ss were told that, for microteaching to be most valuable, it was desirable to focus on one or two specific teaching skills. Ss were told to focus on the skills of asking probing questions and offering accepting reactions. They were told to use these skills whenever they seemed appropriate during the microteaching lessons. Ss also received at this time brief written definitions of the two skills, including definitions of the three types of probes.

The microteaching test. Each S taught the 5-minute lesson he had prepared to two different groups of 4-5 junior high school pupils. The purpose of the first microteaching session was to desensitize Ss to microteaching procedures and particularly to the use of the videotape equipment. After completing his first teaching session, each S was given a 5-minute

"break" while the second group of pupils took their places in the microteaching room. The S then taught the same lesson to the new group of pupils. This second microteaching lesson was considered the microteaching test. Each of the microteaching sessions was carefully timed, so that the videotaped lessons were exactly 5-minutes in duration.

The videotape concept test and the printed concept test. On the day following the completion of the microteaching test by all Ss in a given group, that group of Ss met for the purpose of taking the two concept tests. Prior to this time, Ss were unaware of the purpose of this meeting. At the beginning of the period, Ss were informed that the purpose of the meeting was to test their ability to recognize the skills of asking probing questions and offering accepting reactions, which they had previously used during their microteaching lessons. They were told that they would take two tests: the first, a videotape test in which they would be required to identify the two skills as they occured during a videotaped lesson, and the second, a printed test in which they would be required to identify the two skills from excerpts of written transcripts of lessons. They were told that their instructors were interested in finding out how much their ability to perform these skills, as evidenced by their microteaching lessons, correlated with their ability to recognize the related concepts, as evidenced by their performance on the two concept tests. They were told that this information would assist their instructors in planning future instructional experiences. Ss appeared to accept without question this rationale for taking the two tests.

Immediately following the above introduction, Ss were given brief written definitions of the two concepts, including definitions of the three types of probes. These definitions were identical to the ones which Ss had received prior to the microteaching test. Ss were given 5 minutes in

which to review the definitions of the concepts.

After 5 minutes, the copies of the definitions were collected. Ss were then given the answer sheet to accompany the videotape concept test. The videotape test was then administered. The directions for taking the test and marking the answer sheets were contained in the videotape test. The test took 25 minutes to complete. As soon as Ss had completed the test, their answer sheets were collected. The printed concept test was then administered. The test was not timed and Ss were told that they could leave as soon as they had completed the test.

Results

Since each of the six hypotheses tested in the present study involved a priori and directional predictions, one-tailed t tests were used to analyze the data of the three criterion tests. The descriptive statistics for each of the tests are reported in Table 1. The results of the planned comparisons are reported in Table 2.

Hypotheses Concerning Direct or Intended Outcomes

Hypothesis I: Trainees who receive only protocol instruction will perform better on tests of concept recognition than a control group. Two tests, the videotape concept test and the printed concept test, were used as the criterion measures to test this hypothesis. The results of the statistical analyses of the data from the tests (see Table 2) were not consistent. On the videotape concept test the difference between the protocol-only treatment and the control group was not significant, although the difference was in the direction predicted. However, on the printed concept test the difference between the two groups was significant at the .05 level. The results of the criterion tests provide only equivocal support for Hypothesis I.

TABLE 1

Criterion Tests: Means, Standard Deviations, and Ranges of Scores

Treatment	N	$\bar{X}$	SD	Range
Videotape Concept Test				
Group 1 (Protocol)	9	43.667	1.581	41-46
Group 2 (Skill)	9	44.556	2.068	41-47
Group 3 (Protocol & Skill)	10	45.900	2.283	42-48
Group 4 (Control)	10	42.100	3.143	37-48
Printed Concept Test				
Group 1 (Protocol)	9	68.222	4.295	60-74
Group 2 (Skill)	9	67.000	5.292	60-76
Group 3 (Protocol & Skill)	10	71.600	3.438	64-76
Group 4 (Control)	10	62.700	7.258	52-72
Microteaching Performance Test				
Group 1 (Protocol)	9	21.778	7.311	14-32
Group 2 (Skill)	9	22.000	7.089	11-33
Group 3 (Protocol & Skill)	10	22.300	8.220	7-35
Group 4 (Control)	10	14.100	7.156	4-24

TABLE 2

Criterion Tests: Results of Planned Comparisons Using One-Tailed *t* Tests

Groups Compared		*df*	*t*	Significance
Videotape Concept Test				
1(P)	vs. 4(C)	17	1.347	NS
1(P)	vs. 2(S)	16	1.024	NS
3(P&S)	vs. 1(P)	17	2.450	$p < .025$
Printed Concept Test				
1(P)	vs. 4(C)	17	1.988	$p < .05$
1(P)	vs. 2(S)	16	0.538	NS
3(P&S)	vs. 1(P)	17	1.902	$p < .05$
Microteaching Performance Test				
2(S)	vs. 4(C)	17	2.413	$p < .025$
2(S)	vs. 1(P)	16	.065	NS
3(P&S)	vs. 2(S)	17	.085	NS

However, of the two tests, the printed concept test is probably the more accurate measure of concept acquisition. First of all, the correlation between the two tests is .4229. While this correlation is significantly different from zero, it is nevertheless low and leaves much of the variance of the test scores unexplained. Of the two tests, it is likely that the printed test is measuring primarily concept acquisition, whereas the videotape concept test may also be measuring other variables, such as visual perceptive ability. Secondly, the reliability of the videotape concept test is greater than the reliability of the printed concept test (see pp. 6 & 7). Thirdly, the printed concept test is a more sophisticated measure of concept acquisition since it requires Ss to distinguish among the various types of probes, whereas the videotape test requires Ss only to distinguish between probes and non-probes. It may be possible for Ss who have received only definitional exposure to the concepts to categorize dichotomously. Additional instruction may be required, however, to enable them to differentiate subcategories. It would appear, then, that the results of the printed test should bear the greater weight, when, as in the present case, the results of the two tests are not consistent.

Hypothesis II: Trainees who receive only skill training instruction will perform better on a skill performance measure than a control group. The microteaching test was used as the criterion measure to test this hypothesis. Analysis of the data from the microteaching test (see Table 2) showed that the mean of the skill training-only treatment was significantly greater than the mean of the control group at the .025 level. Hypothesis II was supported by the data.

Hypotheses Concerning Differential Outcomes

Hypothesis III: Trainees who receive only protocol instruction will perform better on tests of concept recognition than trainees who receive only skill training instruction. The videotape concept test and the printed concept test were used as the criterion measures to test this hypothesis. The results of the tests were consistent. Analysis of the data from both tests (see Table 2) showed that the mean of the protocol-only treatment was not significantly different from the mean of the skill training-only treatment. On the printed test, the difference between the means of the two treatments, while not significant, was in the direction predicted. On the videotape concept test, the difference between the means of the two treatments was neither significant nor was it in the direction predicted. Hypothesis III was not supported by the data.

Hypothesis IV: Trainees who receive only skill training instruction will perform better on a skill performance measure than trainees who receive only protocol instruction. The microteaching test was used as the criterion measure to test this hypothesis. Analysis of the data from the microteaching test (see Table 2) showed that the mean of the skill training-only treatment was not significantly greater than the mean of the protocol-only treatment. Hypothesis IV was not supported by the data.

Hypotheses Concerning Combined-Effects Outcomes

Hypothesis V: Trainees who receive both protocol and skill training instruction will perform better on tests of concept recognition than trainees who receive only protocol instruction. The videotape concept test and the printed concept test were used as the criterion measures to test this hypothesis. The results of the tests were consistent. Analysis of the data from each test (see Table 2) showed that the mean of the com-

bined protocol and skill training treatment was significantly greater than the mean of the protocol-only treatment. On the videotape concept test, the difference between the means of the two treatments was significant at the .025 level. On the printed concept test, the difference between the means of the two treatments was significant at the .05 level. Hypothesis V was supported by the data.

Hypothesis VI: Trainees who receive both protocol and skill training instruction will perform better on a skill performance measure than trainees who receive only skill training instruction. The microteaching test was used as the criterion measure to test this hypothesis. Analysis of the data from the microteaching test (see Table 2) showed that the mean of the combined protocol and skill training treatment was not significantly greater than the mean of the skill training-only treatment. Hypothesis VI was not supported by the data.

Post Hoc Comparisons

Certain post hoc comparisons were made in order to obtain further information from the data. Of the six possible pair-wise comparisons for each of the criterion tests, only three were directly predicted by the hypothesis and were tested by means of one-tailed t tests (see Table 2). Since not all of the three planned pair-wise comparisons for each of the criterion tests were significant, it was of especial interest to determine whether any of the remaining pair-wise comparisons were significant.

A one-way analysis of variance of the videotape concept test yielded $F(3, 34) = 4.525$ ($p < .01$). Results of Newman-Keuls post hoc comparisons of groups not previously compared indicated that the mean of the combined protocol and skill training treatment was not significantly greater than the mean of the skill training-only treatment. However, probability that

the mean of the skill training-only treatment was significantly greater than the mean of the control group was less than .10. Furthermore, the mean of the combined protocol and skill training treatment was significantly greater than the mean of the control group ($p < .01$).

On the printed concept test a one-way analysis of variance yielded $F(3, 34) = 4.819$ ($p < .01$). Results of the Newman-Keuls post hoc comparison of groups not previously compared indicated that the mean of the combined protocol and skill training treatment was not significantly greater than the mean of the skill training-only treatment. Nor was the mean of the skill training-only treatment significantly greater than the mean of the control group. However, the mean of the combined protocol and skill training treatment was significantly greater than the mean of the control group ($p < .01$).

On the microteaching test a one-way analysis of variance yielded $F(3, 34) = 2.78$ ($p < .10$). Results of the Newman-Keuls post hoc comparisons indicated that none of the means of the three experimental treatments was significantly different from one another, although the probability that they were all significantly greater than the mean of the control group was less than .10.

Discussion

The results of the study appear to indicate the following:

1. Protocol instruction and skill training instruction (as used in the present study) do lead to the acquisition of educationally relevant concepts and teaching skills, respectively. The hypotheses concerning direct outcomes were supported.
2. Protocol instruction or skill training instruction alone do not appear to lead to differential outcomes. That is, both of these types of instruction generally lead to the acquisition of educa-

tionally relevant concepts and teaching skills. The hypotheses concerning differential outcomes were not supported.

3. A combination of protocol instruction and skill training instruction is at least as effective, and frequently significantly more effective, than either type of instruction used alone.

Before the implications of these findings can be discussed, several limitations in both the design of the study and the criterion tests used should be mentioned.

Limiting Factors

Three limitations in the general design of the study should be noted since they may influence an interpretation of the results of the study, particularly in terms of offering a possible explanation as to why certain hypotheses were not supported by the data.

1. The number of subjects was small. It should be noted that the number of Ss in each treatment ranged from nine to ten. It is a well known fact that the smaller the number of Ss in an experiment, the greater must be the differences between them in order to obtain statistical significance.

2. The control group may have in fact been a treatment. Although Ss in the control group received no classroom instruction in the concepts and skills tested in the study, they did receive written definitions of the concepts and skills and explicit directions to use them during the microteaching test. While the purpose of the definitions and instructions was to keep from artifically inflating the differences between the control group and the experimental treatments on the criterion measures, the definitions and instructions may have inadvertently functioned as a treatment. In addition, the actual microteaching test may also have constituted a treatment and may have affected the control group Ss' scores on the two concept tests which they took following the microteaching test.

There is some evidence from the data that the control group differed significantly on the two concept tests from the groups on which the tests had been standardized. On the videotape concept test the mean of the control group was significantly greater than the mean of the group on which the test had been standardized ($t = 2.53$; $df = 42$; $p < .02$). On the printed concept test the variance of the control group was significantly smaller than the variance of the group on which the test had been standardized ($F = 4.68$; $df = 31/9$; $p < .01$).

3. The time devoted to experimental instruction was not held constant across the three experimental treatments. It was impossible to keep both the total instructional time and the total time spent on the experimental instruction constant across treatments. It was decided to keep the total instructional time constant in the study. Consequently, Ss in the combined protocol and skill training treatment received twice the amount of experimental instruction as Ss in either the protocol-only treatment or the skill training-only treatment (see pp. 8).

This time factor is of particular importance since the combined protocol and skill training treatment was the most potent treatment in the study. On the three criterion measures, the mean of the combined protocol and skill training treatment was always greater than the mean of any of the other treatments or the control group, although the differences were statistically significant in only five of nine comparisons. Since the combined protocol and skill training treatment was the most potent treatment, the time spent on experimental instruction (as opposed to time spent on non-related instruction or a combination of the two) is crucial. The question arises whether the combined treatment was the most effective because it combined elements of both a conceptual and a performance nature or simply because twice the

amount of time was devoted to experimental instruction in the combined treatment as had been devoted to it in either the protocol-only treatment or the skill training-only treatment.

In addition to the limitations in the general design of the study, certain limitations in the three criterion tests used in the study must be mentioned, particularly insofar as these limitations may affect the interpretation of the results of the study.

The videotape concept test was originally designed as an innovative approach to testing concept acquisition in an experimental format. Three limitations of the test should be noted. First of all, a "topping out" phenomenon was noted both in the standardization procedures for the test and in the present study. In a pilot study to test the responsiveness of the instrument to the same experimental instruction used in the present study, the difference between the pre- and post-test scores of subjects was highly significant ($t = 5.879$; $df = 32$; $p < .0005$). Since the degree of significance was so great, it was assumed that the "topping out" phenomenon would not seriously interfere with or influence the results of the present study. However, this assumption appears not to have been warranted. While the videotape concept test may be sensitive enough to pick up pre- and post-test differences on the same group of Ss, it may not be sensitive enough to pick up differences between groups of Ss exposed to variations in the experimental instruction.

Secondly, the videotape concept test required Ss to make only very gross discriminations between examples and non-examples of the concepts of probing and accepting reactions. In this sense, the videotape concept test was a less sophisticated measure of concept acquisition than the printed concept test, which required subjects to further discriminate among the

various types of probes.

Finally, the correlation between the videotape concept test and the printed concept test, as mentioned earlier (see p. 14), is .4229. While this correlation is significantly different from zero, it is nevertheless low and leaves most of the variance of the test scores unexplained. Of the two tests, it is likely that the printed test is measuring primarily concept acquisition, whereas the videotape concept test may also be measuring other variables, such as visual perceptive ability.

The printed concept test has already been discussed to some extent in the preceding section concerning the limitations of the videotape concept test. One limitation, however, should be noted. As in the case of the videotape concept test, a "topping out" phenomenon was also observed for the printed concept test.

The limitations of the microteaching test result from the method used for scoring the test. It should be recalled that a S's score was arrived at simply by counting the number of times he asked a probing question or offered an accepting reaction. The total number of probes and accepting reactions a S used during the 5-minute microteaching test lesson constituted his score. Two limitations must be noted for this method of scoring the test. First of all, in assessing a S's use of these behaviors, it may well have been more appropriate to have used a qualitative measure of skilled performance rather than a merely quantitative one. Use of the latter may have masked real differences among the various treatments. Secondly, the procedure used for scoring the microteaching test may also have masked real differences among the treatments because it failed to take into consideration variations in Ss' rates of responding, variations in pupil behavior, and variations in the pacing of different subject-matter lessons.

Implications

Before discussing the implications of the present study, it might be well to review its major findings once more:

1. Protocol instruction and skill training instruction (as used in the present study) do lead to the acquisition of educationally relevant concepts and teaching skills, respectively.
2. Protocol instruction or skill training instruction alone do not appear to lead to differential outcomes. That is, both of these types of instruction generally lead to the acquisition of educationally relevant concepts and teaching skills.
3. A combination of protocol instruction and skill training instruction is at least as effective, and frequently more effective, than either type of instruction taken alone.

Certain implications for the developers and users of protocol and skill training materials follow from the results of the present study.

Implication 1. When developing or selecting materials to teach specific skills or concepts which imply related skills, it is most desirable to include both a strong protocol (conceptual) component and a strong training (performance) component. The combination of both components is likely to lead to the greatest amount of conceptual and performance gains.

Implication 2. When only one type of instructional material can be developed or used, and the developer or user must choose between protocol materials or skill training materials, his choice should be based on such factors as cost, ease of use, resources available, etc., since either type of instructional materials will lead to approximately the same conceptual and performance gains.

Implication 3. All other factors being equal, the developer who is primarily or exclusively concerned with the development of protocol mate-

rials might consider emphasizing, in his choice of concepts to be portrayed, the vast range of educationally relevant concepts which do not imply related teaching skills.

Implication 4. Certain teaching skills, particularly those which are already within the average teacher trainee's behavioral repertoire to some degree (e.g., questioning skills) may be acquired with minimal practice. With such skills, all that may be required in order for teacher trainees to successfully perform the skill is a certain amount of cognitive structuring (e.g., defining and giving examples of the skill, telling the teacher trainee under what conditions he should or should not perform the skill, etc.). Other skills, particularly those which are not already within the average teacher trainee's behavioral repertoire or are highly complex in nature, may require repeated practice with feedback in order for the trainee to acquire the skill.

References

Barnes, H. L. An investigation of the effects of differential instructional materials on concept acquisition and transfer: (Doctoral dissertation, Michigan State University) Ann Arbor, Michigan: University Microfilms, 1972. No. 72-29, 927.

Borg, W. R. The minicourses as a vehicle for changing teacher behavior: A three-year follow-up. Journal of Educational Psychology, 1972, 68, 572-579.

Borg, W. R., Kallenbach, W., Morris, M., & Friebel, A. Videotape feedback and microteaching in a teacher training model. The Journal of Experimental Education, 1969, 37(4), 9-16.

Borg, W. R., Kelley, M. L., Langer, P., & Gall, M. The mini-course: A microteaching approach to teacher education. Beverly Hills, Calif.: Macmillan Educational Services, 1970.

Campbell, D. T. & Stanley, J. C. Experimental and quasi-experimental designs for research. Chicago: Rand McNally, 1966.

Gliessman, D. An introduction to protocol and training materials. Acquiring Teaching Competencies: Reports and Studies. National Center for the Development of Training Materials in Teacher Education, Indiana University, 1972, No. 1.

Hudgins, B. Some implications for the design of training materials in teacher education from research on learning complex skills. Acquiring Teaching Competencies: Reports and Studies. National Center for the Development of Training Materials in Teacher Education, Indiana University, 1974, No. 5.

Ingersoll, G. & Kleucker, J. Analysis of teacher-pupil interaction: Reacting to pupil responses. Bloomington, Indiana: National Center for the Development of Training Materials in Teacher Education, 1971.

Johnson, R. B. The effects of prompting, practice and feedback in programmed videotape. American Educational Research Journal, 1968, 5, 73-79.

Koran, M. L., Snow, R., & McDonald, F. J. Teacher aptitude and observational learning of a teaching skill. Journal of Educational Psychology, 1971, 62, 219-228.

Langer, P. & Allen, G. E. The minicourse as a tool for training teachers in interaction analysis. Paper presented at the meeting of the American Educational Research Association, Minneapolis, March, 1970.

Okey, J. & Walden, J. Skills in teacher-pupil interaction: Developing comprehension through accepting and probing reactions. Bloomington, Indiana: National Center for the Development of Training Materials in Teacher Education, 1971.

Smith, B. O. & Orlosky, D. E. The development of protocol materials. Acquiring Teaching Competencies: Reports and Studies. National Center for the Development of Training Materials in Teacher Education, Indiana University, 1973, No. 3.

Wallen, C. & Utsey, J. Training teachers to determine learner achievement of objectives in reading instruction. Paper presented at the annual meeting of the American Educational Research Association, Los Angeles, February, 1969.

Previous Issues in the Series:

Report Number

1. Gliessman, David An Introduction to Protocol and Training Materials. September, 1972.

   Hudgins, Bryce B. The Portrayal of Concepts: An Issue in the Development of Protocol Materials. September, 1972.

2. Okey, James R. and Ciesla, Jerome L. Designs for the Evaluation of Teacher Training Materials. October, 1972.

3. Smith, B. Othanel and Orlosky, Donald E. The Development of Protocol Materials. January, 1973.

4. Okey, James R. and Brown, Jerry L. Competencies for Performance-Based Teacher Training. November, 1973.

   Levie, W. Howard Technical Quality and Color in Training Films. November, 1973.

5. Hudgins, Bryce B. Self-Contained Training Materials for Teacher Education: A Derivation from Research on the Learning of Complex Skills. February, 1974.

A limited supply of the above reports is still available. While the supply lasts, single or multiple copies may be obtained by writing to:

National Center for the Development of
Training Materials in Teacher Education
Indiana University
2805 E. Tenth Street
Bloomington, Indiana 47401